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REVIEW OF THE TENEBRIONID TRIBE ANEPSIINI (COLEOPTERA)

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**ABSTRACT:** The systematics of the 13 known species of Anepsiini is reviewed. Cladistic relationships support recognition of four genera, including the new genus *Batuliomorpha*. Keys, descriptions, and diagnoses are provided for genera and species. New species are: *Anepsius minutus*; *Batuliomorpha comata*, *B. imperialis*, and *B. tibiodentata*; *Batuliodes wasbaueri*, *B. obesus*, and *B. spatulatus*. *Anepsius confluens* (Blaisdell) is newly transferred to *Batuliodes*. In *Anepsius* and *Batuliodes* the more primitive species are surface dwellers, while the more derived ones are strongly modified for a psammophilous existence. *Botulius* and *Batuliomorpha* contain only psammophilous species.

INTRODUCTION

The Anepsiini comprise a small group of little-studied species that occupy arid or subarid habitats in western North America. Aside from the rather brief consideration of higher classification by Doyen and Lawrence (1979), previous systematic treatments have consisted of isolated descriptions of species (LeConte 1851; Casey 1907; Blaisdell 1923) or very superficial analyses of generic interrelationships (LaCordaire 1859; Horn 1970; Casey 1907). During the last few years, a number of undescribed species have been collected from sand dunes in southeastern California and Baja California. Several of these are strongly modified for a psammophilous existence, and significantly increase the morphological variability within Anepsiini. Conversely, a number of names proposed by Casey (1907) need to be placed in synonymy. In addition, this paper reevaluates generic interrelationships and provides keys to genera and species.

MATERIALS AND METHODS

*Anepsius delicatulus* is commonly found under stones, but other members of Anepsiini are sel-

dom noticed, due to their small size, cryptic coloration, lethargic movements, and nocturnal activity. They are most effectively collected in pitfalls, particularly those left in the substrate for extended periods with a preservative such as ethylene glycol. Dune-inhabiting species may be sifted from the sand about the bases of plants, but several of these species are small enough to pass through the mesh of standard window screening.

Morphological terminology generally follows that in Doyen (1966). Orientation and terminology used in describing the legs follow Doyen (1984). Measurements were made with an ocular micrometer and grid. Elytral length (EL) is the distance from the posterior tip of the scutellum to the elytral apex, measured parallel to a frontal plane through the body. Pronotal length (PL) is measured along the midline; elytral and pronotal widths (EW, PW) are maximum dimensions perpendicular to a sagittal plane.

Type specimens of all described species were examined. Holotypes of species described by Casey (1907) and considered in this paper are located in the United States National Museum; those described by Blaisdell (1923, 1943) are located in the California Academy of Sciences.

## BIOLOGY

Life histories of Anepsiini are essentially unknown. Larvae have not been associated with any species. I was unable to obtain eggs or larvae from caged adults of *Anepsius delicatulus* and *Batuliomorpha comata*, although some adults survived for many weeks or months.

*Anepsius delicatulus*, *Batuliodes confluens*, and probably *A. minutus* and *B. rotundicollis* are surface-dwelling species that hide under stones and in other refuges. *Anepsius delicatulus* is occasionally encountered on the soil surface at night. All four species appear to be active throughout the year except during the coldest months in the northern portions of their ranges. For example in a pitfall survey of ground-dwelling arthropods at Owens Lake, Inyo County, California *Anepsius delicatulus* was recorded in all but three months, with peak numbers in May (Fig. 1) (F. Andrews, A. Hardy; personal communication). In warmer portions of its range, such as the San Joaquin Valley and the Los Angeles Basin, specimens have been collected in every month. A similar pattern was found for *Batuliodes rotundicollis* in the Eureka Valley (Mono County, California) (Andrews et al. 1979), where activity was almost entirely restricted to the period between May and September (Fig. 1). Presumably this reflects the relatively severe climate of the Eureka Valley at about 915 m. Once again, in warmer parts of *B. rotundicollis*'s range, collection records exist for most months of the year.

These more generalized, surface-dwelling species range over a variety of sandy and rocky substrates in arid and subarid habitats. In their survey at Owens Lake, Andrews et al. recorded *Anepsius delicatulus* principally from the *Larrea*, *Franseria dumosa*, *Atriplex-Franseria*, and *Atriplex confertifolia* associations recognized by Matson (1976). These plant associations occur on alluvial substrates that are not strongly alkaline. Only three of the beetles were recorded from alkali scrub associations, and none were taken from sand dune habitats. However, *Anepsius delicatulus* is common on the remnant sand hills near Antioch, Contra Costa County, California, and I have taken it from aeolian sand in the Ciervo Hills, Fresno County (J. Doyen Lot #75C4).

In the Eureka Valley *Batuliodes rotundicollis* was common on rocky hillsides and alkali scrub, but was never found on the aeolian dunes. Specimens have been recorded from the Saline

Valley Dunes (Inyo County, California), but appear to be much more abundant on harder substrates.

In contrast to the more generalized group of species discussed above, *Anepsius montanus*, *Batuliodes obesus*, *B. spatulatus*, *B. wasbaueri*, *Batulius setosus*, and the species of *Batuliomorpha* are all apparently restricted to aeolian sand. Adults shelter beneath the sand surface during the day, sometimes about the bases of vegetation, emerging nocturnally. Available collection records indicate that these species are active during the winter and spring months, but no intensive surveys have been conducted throughout the year. The habits of *A. valens* are unknown.

## HIGHER CLASSIFICATION OF ANEPSIINI

In the paper in which he originally described *Anepsius* and *Batulius*, LeConte (1851) did not use higher level categories. Thus LaCordaire (1859) made the initial tribal placements, including *Anepsius* in his Triboliides and *Batulius* in his Ulomides vrais. His placement of these genera in tribes possessing defensive glands was based on superficial characters. The fundamental differences in abdominal structure were unrecognized at that time. Separation of *Anepsius* and *Batulius* was necessary in his classification because of their different mesocoxal configurations. LeConte (1862) included both genera in his Anepsiini, which he placed in his subfamily Tentyriinae. Horn (1870) removed *Batulius* to his tribe Batuliini, which he left in Tentyriinae, but he transferred Anepsiini to the Asidinae. These changes, again based on the differences in mesocoxal structure, were subsequently followed by LeConte and Horn (1883). Casey (1907) recognized the close relationship between *Anepsius* and *Batulius*, suggesting that all should form a single tribe, probably without subdivisions. He stressed the strong overall similarity, emphasizing especially the unusual elytral sculpture shared by *Anepsius* and *Batuliodes*, which he split from *Batulius* to receive *rotundicollis* LeConte. Casey was uncertain whether to apply Anepsiini or Batuliini as the proper name, but his comments regarding relationship and classification were essentially correct. Subsequent catalogers (Leng 1920; Gebien 1937; Papp 1961) continued to recognize two tribes, but heeded Casey by giving them adjacent positions in the subfamily Asidinae. Doyen and

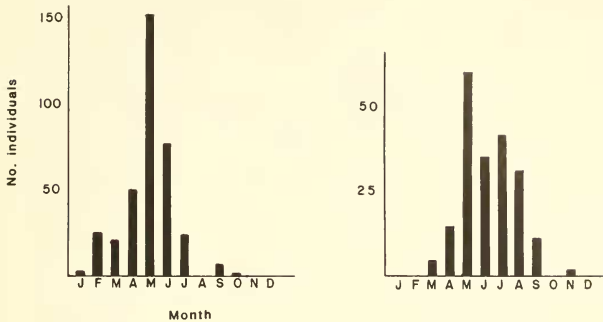


FIGURE 1. Left: Seasonal distribution of *Anepsius delicatulus* at Owens Lake, Inyo County, California (Based on data from October, 1977 to January, 1979, courtesy of F. Andrews and A. Hardy, California Department of Food and Agriculture.) Right: Seasonal distribution of *Batuliodes rotundicollis* in the Eureka Valley, Mono County, California. (Based on data from October, 1977 to January, 1979, from Andrews, et al. 1979.)

Lawrence (1979) redefined *Anepsiini* to include *Batuliini* and suggested that *Batuliodes* should be placed in synonymy under *Batulius*. That classification is followed here, except that I resurrect *Batuliodes* as a valid name for the reasons detailed below.

Blackwelder (1945), and later Papp (1961), recognized the subfamily *Batuliinae* without formal definition. From their checklists it is impossible to determine which taxa, if any, they intended to include other than *Batuliini*.

Relationships of *Anepsiini* to other groups of *Tentyriinae* are uncertain. The relatively small mentum is shared with tribes such as *Stenosini*, *Coniointini*, *Lachnogyini*, *Cnemoplattini*, and *Cryptochilini*, as well as difficult to place genera such as *Idisia* Pascoe. Divided eyes are widespread in *Stenosini* (undivided in *Stenosis*) and also occur in *Typhlusechus*, *Alaudes*, and *Boromorphus*. A further character shared by *Anepsiini* and most *Stenosini* is the integration of the elytral bases and the scutellum into the collarlike mesothorax, which is amplexed into the prothorax. The anterior, amplexed parts of the elytra and the scutellum are depressed below the level of the elytral disk. The scutellum is visible only if the prothorax is moved forward, relative to the elytra. In tribes such as *Coniointini* a relatively

small portion of the elytra is incorporated into the mesothoracic collar. In *Cryptoglossini*, a relatively large part of the elytra forms the dorsolateral parts of the collar, but the scutellum remains exposed on the elytral disk. I have not surveyed these complex structures extensively in *tentyrioid* *Tenebrionidae*, and their taxonomic value is uncertain. Final resolution of the relationships of the *tentyrioid* tribes will require detailed morphological comparisons across the entire subfamily. At present the *Anepsiini*, *Stenosini*, and probably the *Eurychorini* (Koch 1955) may be considered to comprise a somewhat isolated clade within *Tentyriinae*.

Relationships within *Anepsiini* were assessed by analyzing 27 characters across all the species. Character polarities were determined by out-group comparison with other tribes of *Tentyriinae*. This procedure is rendered difficult by the large size and structural diversity of many of these tribes, which may themselves show more than one state for some characters. Characters and character-state polarities are discussed below and listed in Appendix 1.

*Antennal configuration (Characters 1-5).* In *Anepsius delicatulus* the antennae are gradually enlarged to the 10th segment (Fig. 9), have no distinct club, and are relatively long. In all other spe-

cies the last 3 or 4 segments are abruptly enlarged as a slight but distinct club (Fig. 7-8). Clavate antennae are commonplace in Tentyriinae and are therefore considered the primitive condition in Anepsiini. The two types of clubs probably developed independently, since the lineages in which they occur differ in numerous other features.

In burrowing species antennae are variably shortened. This derived condition, along with several other features correlated with a strongly psammophilous mode of life, has apparently arisen independently several times. Analogous shortening of antennae occurs in many other psammophilous Tenebrionidae.

It is difficult to assign polarity to Character 5 (shape of apical antennal segment). Probably the subquadrate condition is associated with psammophily and shortening of the antennae.

*Tentorial configuration (Character 6).* In most Anepsiini the tentorium consists of subvertical lateral laminae, connected posteriorly by a transverse bridge. This primitive condition prevails through a great majority of Tenebrionidae. In *Batuliomorpha*, the posterior space between the transverse bridge and the ventral part of the occipital foramen is closed by a sheet of cuticle (Fig. 2). As far as known, this state is unique to *Batuliomorpha*. Possibly it is correlated to the functioning of the mouthparts, whose muscles attach in part to the tentorium.

*Epistomal margin (Character 7).* Both truncate and emarginate epistoma are common in Tentyriinae. However, the configuration in *Batuliodes*, with rather prominent lateral lobes and a nearly straight medial portion is distinctive and considered derived.

*Submental gland (Character 8).* This secondary sexual feature was discussed in some detail and illustrated by Doyen and Lawrence (1979). It is almost certainly a synapomorphy in Anepsiini, but it is unclear whether its absence in *Batuliodes* represents a primitive lack or a secondary loss.

*Pronotal configuration (Characters 9-12).* In most Tentyriinae the pronotum has distinct angles and carinate lateral margins without fimbriation. This plesiomorphous condition pertains in *Anepsius*. In *Batuliodes*, the posterior angles are strongly obtuse basally but are produced and acute or nearly right angled near the apex. In psammophilous species the pronotal margins become fimbriate, and the lateral carinae may be

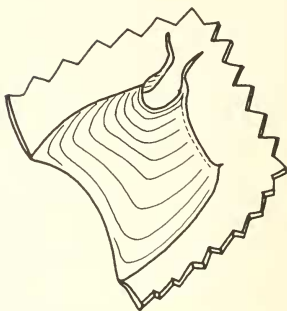


FIGURE 2. Tentorium of *Batuliomorpha comata*, posterior oblique aspect; surrounding cranium removed.

faint or lacking. These latter modifications appear in diverse groups of psammophilous Tentyriinae.

*Sculpture of hypomeron (Characters 13-14).* Polarity of these characters is uncertain.

*Elytral fimbriation (Character 15).* The plesiomorphous, glabrous state occurs in nonburrowing forms. Fimbriae very likely developed independently in all psammophilous lineages.

*Elytral sculpture (Character 16).* As noted by Casey (1907:503), Anepsiinae are characterized by a peculiar pattern of elytral sculpturing. In each row the punctures are intersected anteriorly by a narrow longitudinal carinule. In *Anepsius delicatulus* the anterior edges of the punctures are elevated, producing a characteristic pattern. The same pattern, albeit somewhat modified, is discernible in all except the strongly fossorial species, suggesting that it is primitively present in the anepsiine lineage.

*Ventral setation (Character 17).* Presence of setae is a derived condition correlated with psammophily.

*Mesocoxal closure (Characters 18-20).* These characters were discussed in some detail by Doyen and Lawrence (1979). Mesocoxal cavities bounded laterally by the epimeron, with exposed trochantins, are primitive. Those closed by lobes of the meso- and metasterna are derived. However, it should be noted that, even in those Anepsiini where the epimeron reaches the coxal cavity,

the sternite lobes are closely apposed, constricting the epimeron to a narrow strip. In some other groups of Tenebrionidae, notably Diaperini, mesocoxal closure is variable, possibly related to reduction in body size (Doyen 1984). Casey (1907:503) previously realized the instability of this character in Anepsiini.

*Metasternum length* (Character 21). In flightless Coleoptera, the metasternum commonly becomes much shortened. Although wing loss is pleiomorphic in Anepsiini, the metasternum is relatively long in all genera but *Anepsius*, which is relatively primitive in most other features.

*Protibial configuration* (Characters 22, 24). Apical expansion of the tibiae is frequently associated with psammophily in Tenebrionidae. Modification of the tibial spurs is often an associated feature, and in extreme cases one spur may be entirely lost, as in *Uniuugulum* Koch (1962:113). Likewise, fimbriation of the posterior protibial margin often accompanies these other changes.

*Aedeagal configuration* (Character 25). The polarity of this character is uncertain. The ventral surface (primitively dorsal in the noninverted aedeagus) of the tegmen is often only lightly sclerotized; the amount of sclerotization sometimes varies among individuals.

*Body proportions and setation* (Characters 26, 27). Relatively slender, subglabrous bodies are associated with surface dwelling. Obese, foreshortened bodies and long, projecting setae are associated with psammophilous, burrowing habits in many groups of tenebrionidae. These characteristics have probably evolved independently several times in Anepsiini.

#### CLADISTIC RELATIONSHIPS

One possible (hand-generated) cladistic arrangement of Anepsiini appears in Figure 3. This diagram includes the distribution of all characters for which the derived state is shared by at least two species even if the character polarity is not absolutely certain. Autapomorphic characters are described in the species treatments. At the outset it should be explained that psammophilous tenebrionidae that burrow in loose sand commonly share a syndrome of morphological specializations. Important modifications, as discussed by Koch (1961), Doyen (1984:15), and others include the following: enlargement of the foretibiae

for digging; shortening of the antennae; increase in body pilosity, especially as lateral fibriae; and development of obese, rotund body shapes. In addition there is often development of protibial setal fringes, apparently to increase tibial area for digging, and modification of the protarsi or protibial spurs. Parallelism in these characters is particularly evident in the Anepsiini, where most of the same apomorphies characterize psammophilous species of all four genera. Since the generalized body plan is similar throughout Anepsiini, the apomorphic states of these characters are difficult or impossible to distinguish. However, several distinctive structural features, unrelated to psammophily, support the diagram in Figure 3. These are discussed where appropriate below. The characters subject to parallelism should ordinarily be removed before computer analysis. I retain them here to emphasize the extensive level of homoplasy present in Anepsiini.

The primary dichotomy separating *Batuliodes* from the remaining genera is based on differences in the mesocoxal region (Characters 18–20), antennae (Character 2), gular region (Character 8), and epistomum (Character 7). The sculpture of the hypomeron and the configuration of the posterior pronotal angles show derived states in the more generalized, surface-dwelling species. The absence of the derived states of these characters in some of the specialized burrowing species probably represents a secondary absence. Exserted posterior pronotal angles also occur in *Batulius setosus*, but the majority of characters clearly show that *B. setosus* belongs in the *Anepsius* lineage.

*Batuliodes rotundicollis* and *B. confluentis*, the relatively generalized, surface-dwelling species, do not differ in important structural features. However, they differ in several details of cuticular sculpturing and diverge greatly in size and shape of the aedeagus (see species descriptions). The clade comprising *B. wasbaueri*, *B. spatulatus*, and *B. obesus* is united by a series of apomorphic character states related to a psammophilous mode of life. *Batuliodes obesus* is the most specialized member of this clade, having lost the pronotal carina (Character 10), developed dense, long setation on the venter (Character 17), and having entirely lost the elytral carinae (Character 16). In all other characters it is exceedingly similar to *B. spatulatus*. *Batuliodes wasbaueri* lacks apomorphies of the antennae (Character 5) and hypomeral

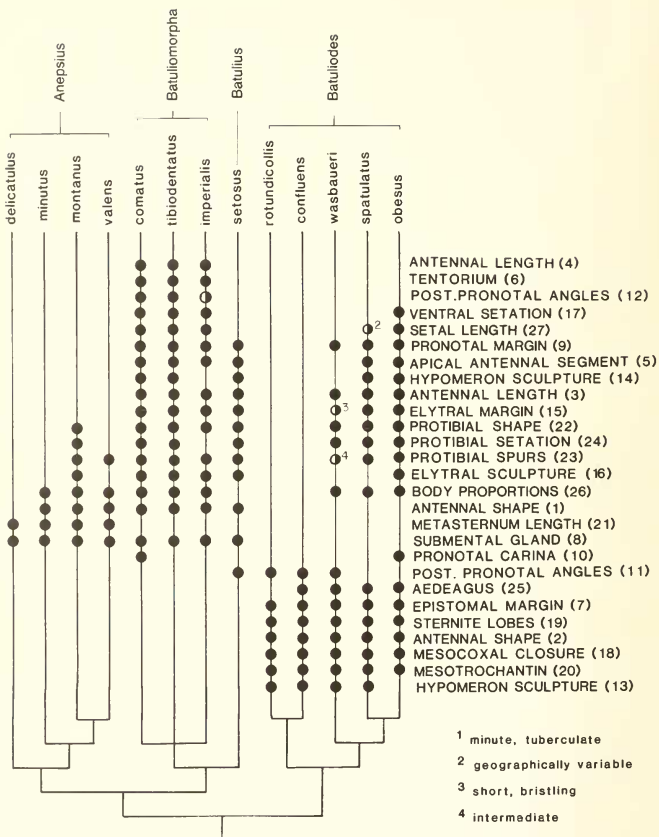


FIGURE 3. Distribution of character states across genera and species of Anepsiini. One possible (hand-generated) cladistic arrangement is indicated by the basal connecting lines. Black dots indicate character states presumed to be apomorphic. Note the numerous parallels among features adapted for life in aeolian sand.

sculpture (Character 14), but shares the remaining apomorphies.

The alternate branch, comprising *Anepsius*, *Batuliomorphus* and *Batulius*, of the cladogram is unified by only a single character, the presence of a submental gland (Character 8) in males. This is shown as an apomorphy in Figure 3, but could also be a primitive feature of *Anepsiini* which has been lost in *Batuliodes*.

*Anepsius* is distinguished by a single apomorphy, the short metasternum (Character 21). Commonly, shortening of the metasternum is correlated with winglessness in Coleoptera. *Anepsiini* are primitively wingless, and in most features *Anepsius* (especially *A. delicatulus*) is the most primitive member of the tribe. Unexpectedly the metasternum is longest in the most specialized burrowing species, and it is possible that the short condition is actually primitive to *Anepsiini*. Within *Anepsius*, *A. valens* and especially *A. montanus* show fossorial specializations of the protibiae and presumably represent a monophyletic clade.

*Batulius* and *Batuliomorpha*, which constitute the remaining lineage, share numerous apomorphic states of characters involved in psammophilous life. On this basis one might recognize only a single genus. However, *Batuliomorpha* is further characterized by a distinctive, obese body silhouette (Character 26), reduction or loss of the posterior pronotal angles (Character 12), and the uniquely apomorphic tentorium (Character 6). In contrast, in *Batulius* the body shape is not markedly different from that in *Anepsius*, and the tentorium is unmodified, while the posterior pronotal angles are strongly exerted, resembling those of *Batuliodes*. These characters suggest that the apomorphic protibial, setal, and antennal character states shared with *Batuliomorpha* arose by convergence.

An alternative arrangement might derive the lineage containing *Batulius* and *Batuliomorpha* from one of the fossorial species of *Anepsius*. Both *A. montanus* and *A. valens* show a few of the apomorphic features related to psammophilous life. However, such an arrangement would require that metasternal length, presumably derived in *Anepsius*, be reversed in *Batulius* and *Batuliomorpha*. It seems more likely that the specializations obviously related to psammophily arose independently in the two lineages.

Within *Batuliomorpha*, the species *comata* and *tibiodentata* share a single, apomorphic feature, the smooth, subglabrous hypomeron. However, this is a common characteristic of psammophilous forms, and in the *Anepsiini* this characteristic occurs independently in *Batuliodes*. Apomorphies distinguish *B. comata* (loss of pronotal carina, Character 10) and *B. tibiodentata* (coarsely tridentate protibia; unique within *Anepsiini*, not shown in Fig. 3). Furthermore, *B. comata* occurs in the southern Mojave Desert, while *B. tibiodentata* inhabits dunes in central and southern Baja California. Without more convincing evidence, it seems preferable to leave the relationships between the three *Batuliomorpha* species unresolved.

#### *Anepsiini* LeConte

*Anepsiini* LeConte, 1862:215; Horn 1870:276; LeConte and Horn 1883:367; Casey 1907:503; Arnett 1960:670; Doyen and Lawrence 1979:346.

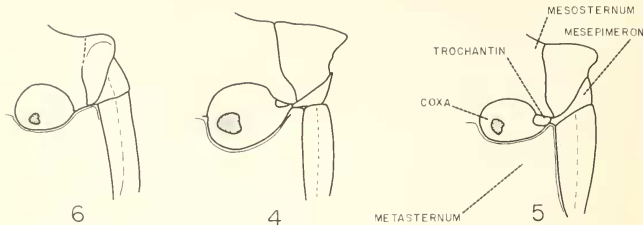
*Batulini* Horn, 1870:270; Casey 1907:497; Arnett 1960:670; Doyen and Lawrence 1979:346 (synonymy).

*Batulinae* Papp, 1961:105.

*Batulini* Papp, 1961:105.

Wingless Tentyriinae 2–6 mm long with globular prothorax and oval abdomen.

FEMALES.—Lateral epistomal sutures usually distinct, medial suture obliterated. Eye completely divided by epistomal canthus and super-tended by low carina; antenna with 11 segments, clavate or with apical 3 or 4 segments forming club; labrum transverse with long, slender tormae with medial processes directed obliquely posteriorly; mandible with small, smooth mola remote from bidentate incisor lobe; maxilla with galea densely setose; lacinia with bidentate uncus; labium subhexagonal, moderate in size, exposing maxillary articulations; tentorium with sides short, bridge thick, or closed posteriorly (Fig. 2). Prosternal process unmarginated, horizontal a short distance behind coxae, then abruptly declivous; mesosternum scarcely excavated. Elytra constricted basally, collarlike, amplexed into prothorax; scutellum angulate or rounded posteriorly, retracted into prothorax, not visible on elytral disk. Mesocoxal cavities closed by sterna or nearly so; mesotrochantin exposed or concealed. Metasternum about one to two times length of mesocoxa. Metendosternite with short, thick stalk; long stout, tapering arms with tendons apical or subapical; median metasternal sulcus and



FIGURES 4-6. Ventral aspect of pterothoraces, showing variation in mesocoxal structure in Anepsiini. 4) *Batuliomorpha comata*, 5) *Anepsius valens*, 6) *Batuliodes rotundicollis*.

internal ridge absent. Femurs stout; foretibia dilated, triangular; tarsi short with few spinose setae beneath. Ovipositor short, thick, with paraproct and coxite subequal; coxite lobes indistinct; gonostyles minute, papilliform, inserted dorsolaterally very near apex of coxite.

MALES.—Aedeagus inverted with paramere 1.1-1.7 times longer than tegmen; median lobe free, its lateral baculi fused proximally (Fig. 12-15). Average length about 10% less than females; submentum perforated by circular opening with tuft of protruding setae (Doyen and Lawrence 1979; Fig. 16-19), except in *Batuliodes*.

LARVAE.—Unknown.

Key to Genera of Anepsiini

- 1. Middle coxal cavity with trochantin exposed; sternal lobes separated by narrow space laterad of coxal cavity (Fig. 4, 5) .....2
- Middle coxal cavity with trochantin concealed; lobes of sternites meeting laterad of coxal cavity (Fig. 6) .....  
.....*Batuliodes* Casey
- 2(1). Metasternum about twice as long as mesocoxa; pronotum and elytra fimbriate along lateral margins; apical antennal segment subquadrate or wider than long (Fig. 7, 8) .....3
- Metasternum about one to one and one-half times as long as mesocoxa; pronotum and elytra subglabrous or with short, appressed setae; apical antennal segment longer than broad (Fig. 9) .....  
.....*Anepsius* LeConte

3(2). Posterior pronotal angles obliterated or represented by minute tubercles; antennal club with three segments; lateral fimbriation long, flying (Fig. 31); venter with numerous long setae ..... *Batuliomorpha*, new genus

— Posterior pronotal angles strongly angulate; antennal club with four segments; lateral fimbriation short, stiff (Fig. 21); venter with few short setae .....  
..... *Batulus* LeConte

**Anepsius** LeConte

*Anepsius* LeConte, 1851:147, 1862:215; Horn 1870:277; LeConte and Horn 1883:367; Casey 1907:503.

TYPE SPECIES.—*Anepsius delicatulus* LeConte; designated by Casey 1907:501.

Relatively slender to moderately obese ( $0.55 \leq EL/EW \leq 0.72$ ) beetles devoid of long flying setae.

Epistomal margin arcuately truncate or very feebly and gradually emarginate; lateral epistomal sutures obscured by sculpturing. Antennal length at least three-fourths head width; flagellum gradually enlarged to 10th segment (Fig. 9) or with terminal 3 segments enlarged to form slight but distinct club (Fig. 10); apical segment longer than broad. Submentum of males perforated by circular opening with tuft of protruding setae. Tentorium consisting of subparallel lateral laminae joined by posterior transverse bridge. Pronotum moderately convex, about one and one-half times broader than long; anterior angles nearly right angled or slightly obtuse, angulate or with apexes briefly rounded; posterior angles broadly obtuse, angulate to briefly rounded, but always



distinct; lateral pronotal carina complete, never fimbriate. Elytra minutely carinate or punctate (*montanus*), with short, appressed setae (*minusus*) or subglabrous. Epipleural carina very narrowly margined; epipleuron narrowed just behind humerus, then subparallel almost to apex. Mesocoxal cavities nearly closed by opposed meso- and metasterna; sternites subequal, not offset (Fig. 5); trochantins exposed. Metasternum length one to one and one-half times length of mesocoxa; venter subglabrous or with short, appressed setae. Foretibia moderately to broadly triangular (Fig. 16-18); protibial spurs subequal or mesal spur enlarged, curved posterior.

Key to the species of *Anepsius*

- 1. Antenna about as long as greatest head width; anterior tibia narrowly triangular (Fig. 16, 18) .....2
- Antenna about three-fourths as long as greatest head width; anterior tibia broadly triangular (Fig. 17) .....  
.....*montanus* Casey
- 2(1). Elytra and venter glabrous or nearly so. . . .3
- Elytra and venter sparsely, evenly covered by short but evident setae . . . .*minusus*, new species
- 3(1). Antenna with last 3 segments enlarged as distinct club; anterior tibia with lateral margin broadly scalloped; spines in central region of anterior margin separated by four to six spine widths (Fig. 18) . . . .  
.....*valens* Casey
- Antenna gradually enlarged to segment 10; anterior tibia with anterior margin entire, spines in central region separated by about two spine widths (Fig. 16) . . . .  
.....*delicatus* LeConte

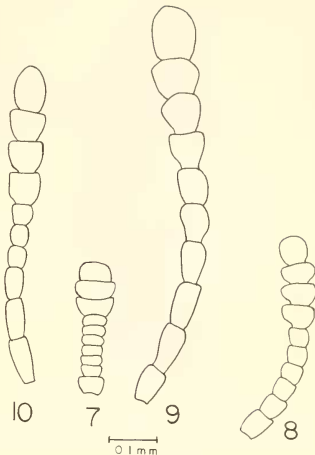
*Anepsius delicatus* LeConte

(Figure 11)

- Anepsius delicatus* LeConte, 1851:148.
- Anepsius catenulosus* Casey, 1907:505 (new synonymy)
- Anepsius atratus* Casey, 1907:506. (new synonymy)
- Anepsius brunneus* Casey, 1907:506. (new synonymy)
- Anepsius nebulosus* Casey, 1907:507. (new synonymy)
- Anepsius bicolor* Casey, 1907:507. (new synonymy)
- Anepsius deficiens* Casey, 1907:507. (new synonymy)

Relatively slender, subglabrous, reddish-black to black beetles with narrowly triangular protibiae.

FEMALE.—Cranium with elongate tubercles on epistomum, becoming tuberculopunctate poste-



FIGURES 7-10. Antennal configuration in Anepsiini. 7) *Batuliomorpha comata*, 8) *Batuliodes spatulatus*, 9) *Anepsius delicatus*, 10) *Batuliodes rotundicollis*.

riorly and punctate on back of vertex; postgena shallowly, reticulately punctate; mentum deeply, reticulately punctate. Antenna about as long as head width, gradually enlarged to 10th segment, without distinct club.

Pronotal disk medially with punctures slightly larger than eye facets, separated by about one puncture diameter; laterally punctures becoming attended ectally by short, longitudinal carinules, producing tuberculopunctate appearance. Lateral carina transversely rugulose. Hypomeron sparsely, coarsely tuberculately, finely, longitudinally strigose or scabrous; prosternum and prosternal process coarsely punctate, asctose.

Elytra seriatly punctate with minute carinules intersecting punctures anteriorly; carinules faint, short medially, becoming longer and stronger in lateral two-thirds; interstitial surfaces minutely alutaceous. Metasternum and metepisternum shallowly, coarsely punctate; punctures separated

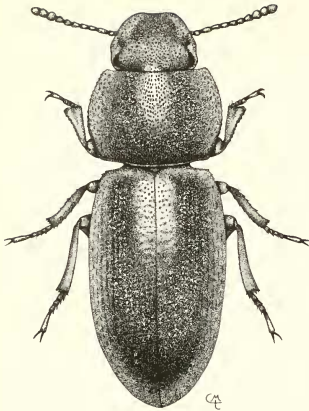


FIGURE 11. *Anepsius delicatulus*, Kern County, California.

by about one puncture diameter medially, becoming closer laterally and subcontiguous on episternum. Abdominal sternites sculpted like metasternum; punctures denser on last two sternites.

Femurs with sparse, short, appressed setae; polished or finely scabrous. Protibia narrowly triangular; lateral margin bearing row of coarse, blunt spines, densest near apical angle (Fig. 16); mesial margin with four to five coarse spines; posterior surface scabrous or rugulose, irregularly set with several coarse spines; apical spurs subequal. Meso- and metatibia with short, sharp spines on all but posterior surfaces.

MALE.—Differs as stated in tribal description. Aedeagus as in Figure 12.

MEASUREMENTS.—EL 1.9–3.1 mm, EW 1.20–1.8 mm, PL 0.8–1.2 mm, PW 1.1–1.8 mm.

HOLOTYPE.—Sex undetermined; in the LeConte Collection (MCZ).

TYPE LOCALITIES.—Colorado River Valley (*A. delicatulus*); southern California (*A. catenulosus*); San Diego, California (*A. aratus*); southwestern Utah (*A. brunneus*); southern California (*A. nebulosus*); Kern County, California (*A. bicolor*); near San Diego, California (*A. deficiens*).

DIAGNOSIS.—*Anepsius delicatulus* differs from all other species in not having a distinct antennal club. It is most similar to *A. minutus* Doyen, but is nearly devoid of visible setae on the pronotum and elytra, whereas *A. minutus* is sparsely pubescent. In addition, the male genitalia are different in shape (Fig. 12, 13).

The distribution of *A. delicatulus* (Fig. 20) is in arid and subarid habitats from Contra Costa County and northern Inyo County, California south through the Central Valley and Owens Valley to northern Baja, California and east to southwestern Utah, central Arizona, and northern Sonora, Mexico. It occurs on rocky or sandy substrates and sometimes on aeolian dunes, as at the Ciervo Hills, Fresno County, California.

The color varies from reddish black to black. Bicolored individuals, corresponding to *A. bicolor* Casey, with reddish prothorax and black abdomen occur in several areas sympatrically with uniformly dark individuals. These color differences are not correlated with differences in other features and may be partly related to age.

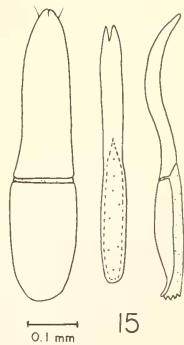
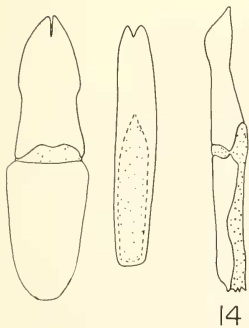
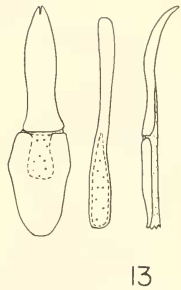
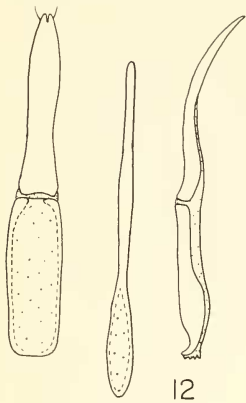
#### *Anepsius minutus*, new species

Slightly obese, brown, sparsely pubescent beetles with narrowly triangular protibiae.

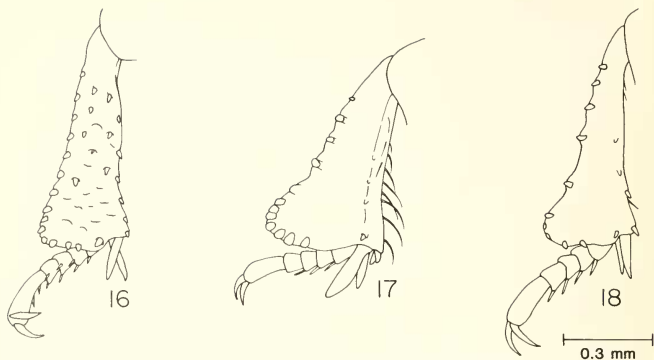
FEMALE.—Cranium set dorsally with nearly round tubercles slightly larger than eye facets; postgena finely scabrous posteriorly, becoming obscurely, coarsely punctate anteriorly; mentum coarsely, shallowly punctate; antenna about as long as head width; apical three segments enlarged as distinct club.

Pronotal disk medially with punctures slightly larger than eye facets, separated by about one to two puncture diameters; laterally punctures attended ecally by short, sharp, longitudinal carinules, producing reticulate appearance; punctures laterally with short, appressed setae. Lateral carina narrowly margined, with sparse row of short, appressed setae. Hypomeron and prosternum finely scabrous with a few coarse, obscure punctures at base of prosternal process; ase-tose or with two to three short setae.

Elytra with fine seriate punctures, each attended anteriorly by minute tubercle and short, appressed seta; interstitial surfaces minutely alutaceous. Metasternum and metepisternum shallowly, coarsely and sparsely, setosely punctate, the latter obscurely so. Abdomen sculpted like metasternum, punctures denser on fifth sternite



FIGURES 12-15. Male genitalia of species of *Anepsius* (ventral aspect, left; lateral aspect, right; median lobe, center). 12) *A. delicatulus*, 13) *A. minutus*, 14) *A. montanus*, 15) *A. valens*.



FIGURES 16-18. Right foretibiae of species of *Anepsius*, anterior aspect. 16) *A. delicatulus*, 17) *A. montanus*, 18) *A. valens*.

and posteriorly on first four, forming subcontiguous rows near margins.

Femora shining, with few obscure punctures and short, appressed setae. Protibia narrowly triangular; lateroapical margin with row of six to eight coarse, blunt spines, densest along apical angle; mesial margin with few fine setae; posterior surface finely sculpted, without spines; apical spurs subequal. Meso- and metatibia with sparse, short setae.

MALE.—Differs as stated in tribal description. Aedeagus as in Fig. 13.

MEASUREMENTS.—EL 1.6-1.7 mm, EW 1.1 mm, PL 0.6 mm, PW 1.0 mm.

HOLOTYPE.—Female from Laredo, Texas, Hubbard and Schwarz, Coll. (USNM).

PARATYPE.—Male from Mexico, Nuevo León, 2 mi NNE China, V-24-1981, J. T. Doyen, on ground at night.

DIAGNOSIS.—*A. minutus* is similar to *A. delicatulus* LeConte in general appearance, but differs in its setose body (subglabrous in *A. delicatulus*).

The holotype is mounted with a specimen of *Myrmecocystus placodops* Forel (Formicidae), but it seems unlikely that *A. minutus* is myrmecophilous, since there are no obvious morphological modifications and no other species of Anepsiini are known to be closely associated with ants.

#### *Anepsius montanus* Casey

(Figure 19)

*Anepsius montanus* Casey, 1907:504.

Moderately obese, dark brown to black, subglabrous beetles with broadly triangular protibiae.

FEMALES.—Cranium with rounded, coarse tubercles on epistomum, becoming tuberculopunctate on vertex or punctate just before pronotum and with tubercles coalescing into carinules above eyes, producing reticulate appearance; postgena and mentum finely, closely punctate or punctatorugose. Antenna about three-fourths as long as head width; apical three segments enlarged as distinct club.

Pronotal disk medially with irregular punctures slightly larger than eye facets, separated by one to three puncture diameters; laterally punctures becoming about twice as large and, in lateral quarters, subcontiguous or contiguous. Lateral carina weakly crenate. Hypomeron finely scabrous with sparse, larger tubercles; prosternum and prosternal process shallowly, coarsely punctate with few long, projecting setae anteriorly.

Elytra with punctures two to three times eye facet in diameter, separated by one to two punc-

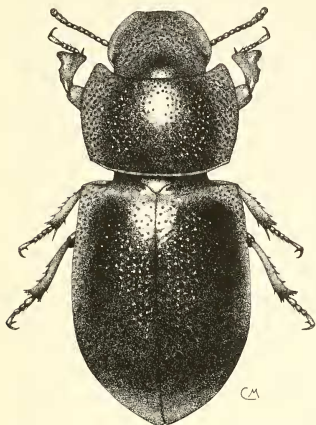


FIGURE 19. *Anepsius montanus*, Lea County, New Mexico.

ture diameters, arranged in rough striae but confused, especially near suture; interstitial surface smooth, polished. Metasternum shallowly, sometimes obscurely punctate; punctures separated by about two puncture diameters medially, by less than one diameter on metepisternum. Abdominal sternites sculpted like metasternum; punctures denser laterally near posterior margin of sternite four and on sternite five.

Femora smooth, polished, with few small punctures and setae. Protibia broadly triangular (Fig. 17); lateral margin weakly crenate basally, abruptly broadened about two-thirds distance to apex, bearing about 12-14 very coarse, blunt spines, separated by two to three spine widths basally, subcontiguous apically; mesial margin with sparse fringe of inclined setae about half length of tarsus; posterior surface concave, with few small irregularities and minute carina near posterior margin; mesial tibial spur much longer, stouter than lateral. Meso- and metatibia with few stout, sharp spines on lateral and posterior surfaces; slender setae on anterior and mesial surfaces.

**MALE.**—Differs as stated in description of tribe. Aedeagus as in Fig. 14.

**MEASUREMENTS.**—EL I, 9-2.4 mm, EW 1.4-1.7 mm, PL 0.8-1.0 mm, PW 1.4-1.6 mm.

**HOLOTYPE.**—Sex undetermined, from Greeley (Weld County), Colorado (USNM).

**ADDITIONAL MATERIAL EXAMINED** (Fig. 20). **Colorado**, Otero County: La Junta, VI-24/25-1885 (1), VI-15-1896 (1). Fremont County: Florence, 12-10 (1). Larimer County: Fort Collins, 24-4 (2). Las Animas County: Trinidad, 6-25 (1). Pueblo County: Pueblo, VII-II-1934 (1). Weld County: Greeley (1), Nunn, VIII-22-1971 (6). **Montana**, (no additional data) (1). **Nebraska**, Sioux County: Glen, VIII-1903 (1). **New Mexico**, Lea County: just east of Caprock (1). **Wyoming**, Albany County: Laramie, III-18-1894 (1). Laramie County: Cheyenne, IV-23-1888 (2). Niobrara County: Lusk, VII-14-1937 (1); (no additional data) (1). **Mexico**, (no additional data; intercepted with cacti at Nogales, Arizona, II-21-1966) (1).

**DIAGNOSIS.**—*A. montanus* is superficially similar to *A. valens* Casey, differing as indicated in the diagnosis for the latter.

Very likely *A. montanus* inhabits aeolian sand. This habit is suggested by morphological adaptations such as the enlarged foretibiae, unequal protibial spurs, and shortened antennae. Some of the collection sites are areas of extensive dune formation, as at Caprock, New Mexico.

#### *Anepsius valens* Casey

*Anepsius valens* Casey, 1907:504.

Moderately obese, dark brown or black, subglabrous beetles with narrowly triangular protibiae.

**FEMALE.**—Cranium tuberculate on epistomum, becoming tuberculopunctate posteriorly and punctate on back of vertex; postgena and mentum finely scabrous or rugulose; antenna about as long as head width; apical three segments enlarged as distal club.

Pronotal disk medially with punctures about one to two times eye facets in diameter, separated by about one puncture diameter; in lateral quarters punctures becoming attended ectally by short carinules, these carinules strongest and punctures shallowest near lateral margins; lateral carina even, punctate. Hypomerion finely scabrous, finely, longitudinally strigose; prosternum and prosternal process finely scabrous, sparsely, obscurely punctate, aetose or nearly so.

Elytra seriatly, somewhat irregularly punctate medially; punctures becoming attended anteriorly by tubercles in lateral thirds, and then by minute carinules in lateral quarters; interstitial surfaces weakly undose. Metasternum shallowly, coarsely punctate; punctures separated by about

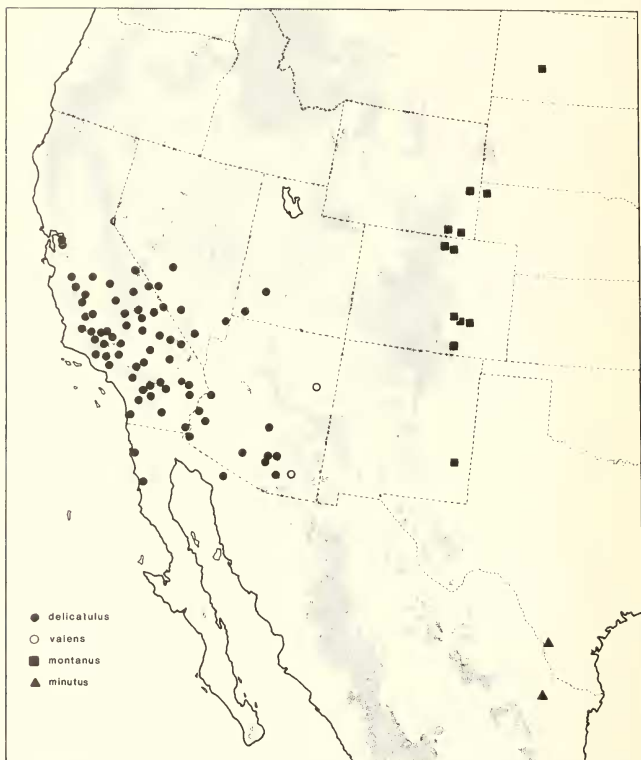


FIGURE 20. Distribution of the species of *Anepsus*.

one to two puncture diameters medially, becoming closer, coarser, and shallower laterally; often obscure on metepisternum. Abdominal sternites sculpted like metasternum; punctures denser along posterior margin of third and fourth sternites and on entire fifth sternite.

Femurs shining, smooth, with few small punctures and appressed setae. Protibia narrowly triangular; lateral margin shallowly crenulate with about seven to eight coarse, blunt spines, densest along apical angle (Fig. 18); mesial margin with few short setae, sometimes with one to two

spines; posterior surface with few irregular carinules or tubercles; mesial tibial spur slightly larger, stouter than lateral. Meso- and metatibia with short, sharp spines set sparsely on all but posterior surfaces; posterior surfaces sparsely setose.

**MALE.**—Differs as stated in description of tribe. Aedeagus as in Fig. 15.

**MEASUREMENTS.**—EL 2.2–2.9 mm, EW 1.4–2.0 mm, PL 0.8–1.1 mm, PW 1.3–1.7 mm.

**HOLOTYPE.**—Sex undetermined, from Holbrook (Navajo County), Arizona, Wickham (USNM).

**ADDITIONAL MATERIAL EXAMINED** (Fig. 20).—**Arizona.** (no further data) (6). Cochise County: Dragoon (4). Navajo County: Holbrook, VII-17-1940 (1), V-23-1941 (3), (no date) (12).

**DIAGNOSIS.**—*A. valens* is superficially similar to *A. montanus* Casey, but has much narrower anterior tibiae (Fig. 17, 18). In *A. valens* the antennae are about as long as the head is wide. In *A. montanus* the antennae are no longer than three-fourths the head width.

The habitat of *A. valens* is unknown, but the lack of structural modifications suggests that it is a surface-dwelling or litter-dwelling species, rather than psammophilous.

#### **Batulius LeConte**

*Batulius* LeConte, 1851:148; 1862:215; Horn 1870:270; LeConte and Horn 1883:364; Casey 1907:497, 498; Arnett 1960:670.

*Batulius* Papp, 1961:105 (misspelling).

**TYPE SPECIES.**—*Batulius setosus* LeConte [1851]; designated by Casey 1907:497.

Relatively slender to moderately obese ( $0.61 \leq EW/EL \leq 0.72$ ) beetles with pronotum and elytra fringed laterally with stiff, projecting setae.

Epistomal margin truncate or very feebly and gradually emarginate; lateral epistomal sutures moderately impressed. Antennal length subequal to head width; terminal three segments enlarged as distinct club; apical antennal segment subquadrate. Submentum of males perforated by circular opening with tuft of protruding setae. Tentorium consisting of subparallel lateral laminae joined by posterior transverse bridge. Pronotum moderately convex, about 1.65 times broader than long; anterior angles nearly right angled, apices briefly rounded; posterior angles broadly obtuse with apices exerted, slightly obtuse; disk abruptly declivous near margin; lateral carina complete, fringed with stiff, projecting setae. Elytra seriatly tuberculopunctate, epipleural margin fringed with row of stiff, projecting setae about as

long as protarsus. Mesocoxal cavities nearly closed by apposed meso- and metasterna; sternites not offset (as in Fig. 5); trochantins exposed. Metasternum length about twice length of mesocoxa; venter subglabrous except for few setae on prosternum. Foretibia broadly triangular (Fig. 23); mesial protibial spur larger than lateral and strongly curved posteriad.

#### **Batulius setosus LeConte**

*Batulius setosus* LeConte, 1851:148.

*Batulius setosus* Papp, 1961:105 (misspelling).

**FEMALE.**—Cranium tuberculate on epistomum, tubercles becoming elongate posteriorly and anteriorly or anterolaterally attending punctures, producing tuberculopunctate or reticulate appearance on vertex; vertex often simply punctate posteriorly; postgena scabrous; mentum with few large, shallow punctures.

Pronotal disk punctate or weakly tuberculopunctate medially, becoming strongly tuberculopunctate laterally, each puncture attended anteriorly or anterolaterally by elongate tubercle or carinule; lateral carina finely serrate or crenulate, with sparse fringe of stiff setae about as long as protarsus; anterior border narrowly margined and setose but not serrate in lateral quarters. Hypomeron shining, very finely alutaceous with few, scattered stigerous punctures and sparse row of

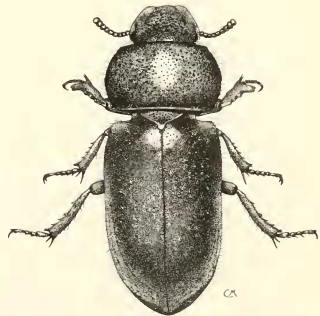


FIGURE 21. *Batulius setosus* from Imperial County, California.

setigerous tubercles just below pronotal carina; prosternum sculpted like hypomeron, setae longest medially; prosternal process becoming more densely punctate, especially along margins.

Elytra seriatly tuberculopunctate, alternate rows more strongly developed; tubercles near suture very small, and punctures very shallow, ill defined; laterally tubercles become larger and punctures become distinct though shallow; disk asetose medially; laterally and on declivity tubercles of alternate rows supertending stiff, inclined setae about one-third to one-half length of protarsus; epipleural carina serrate anteriorly, becoming crenulate posteriorly; epipleuron asetose, smooth or faintly scabrous. Metasternum with sparse, coarse, shallow punctures, densest medially, and each bearing a short, appressed seta and attended anteriorly by a very small tubercle; metasternum very shallowly, obscurely punctate. Abdominal sternites one to three sculpted like metasternum, but punctures denser laterally; sternite four with punctures crowded near poste-

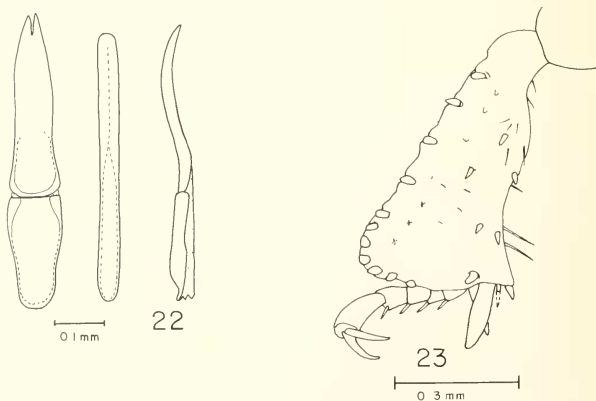
rior margin; sternite five more densely punctate, except near anterior margin. Femora shining, with few small, shallow punctures. Protibia with irregularly crenulate lateral margin, set with about 10–12 coarse, blunt spines, sparse basally, becoming subcontiguous around angle; mesial margin bisinuate, bearing three to five slender setae and one to several coarse spines; posterior surface rough, irregularly set with spines and short setae. Meso- and metatibia flattened, bearing short, sharp spines on anterior surface; slightly longer setae on posterior surface.

**MALE.**—Differs as stated in tribal description. Aedeagus as in Figure 22.

**MEASUREMENTS.**—EL 1.9–3.1 mm. EW 1.2–2.1 mm. PL 0.8–1.3 mm. PW 1.1–1.9 mm.

**HOLOTYPE.**—Male from Gila River valley (MCZ).

**ADDITIONAL MATERIAL EXAMINED** (Fig. 24).—**Arizona.** Yuma County: Fort Yuma, I-21 (3); 9 mi E San Luis, III-18-1980 (14); Tacna, IV-14 (2). **California.** Imperial County: Brawley, V-17-1967 (1); Glamis, IV-23-1972 (2), V-29-1971 (2); 1 mi N Glamis, IV-27/28-1972 (1); 3 mi N Glamis, IV-12-1973 (9); 7 mi SE Glamis, III-25/IV-8-1979 (18); Algodones Dunes, 2.5 mi NE



FIGURES 22–23. *Baudius setosus*. 22) Aedeagus, ventral aspect (left), lateral aspect (right), and median lobe (center); 23) Right foretibia, anterior aspect.



Coachella Bridge #1, IV-17-1979 (12). Riverside County: Blythe, V-6-1970 (1), III-10-1971 (1), IV-10-1971 (3); 1 mi W Blythe, V-23/24-1970 (6); 3 mi W Blythe, V-27-1971 (1); 18 mi W Blythe, I-29-1965 (1); Thousand Palms, III-12/24-1955 (3); Palen Dunes, IV-27-1978 (3). San Bernardino County: Amboy Crater, IV-24-1960 (1). Mexico, Baja California (Norte): Laguna Salada, I-28-1960 (1); San Felipe, II-20-1954 (1).

DIAGNOSIS.—*Batulius setosus* differs from all other Anepsiini in the bisinuate posterior margin of its protibia.

It inhabits aeolian sand dunes or extremely sandy substrates in the southern Mojave and Colorado Deserts. Collection records range from January to late May. Most specimens have been collected in pitfalls.

**Batuliomorpha** new genus

Relatively obese ( $0.70 \leq EW/EL \leq 0.80$ ) beetles with long, flying setae.

Epistomal margin feebly emarginate to slightly arcuate; lateral epistomal sutures weakly to moderately impressed. Antennal length no more than

one-half head width; terminal three segments enlarged as distinct club (Fig. 7), apical segment subquadrate. Submentum of males perforated by circular opening with tuft of protruding setae. Tentorium consisting of subparallel laminae, closed posteriorly between transverse bridge and occiput (Fig. 2). Pronotum about 1.6–1.7 times broader than long, strongly convex, posterior margin depressed; anterior angles nearly right angled, rounded apically; posterior angles obliterated or marked by slight obtuse irregularity; lateral pronotal carina fimbriate, very narrow, carinate, or rudimentary, hypomeron sparsely setose and tuberculate laterally. Elytra tuberculate to tuberculopunctate, setose; epipleural carina indicated by regular row of closely set, setose tubercles. Mesocoxal cavities nearly closed by apposed meso- and metasterna; sternite lobes subequal or metasternal lobe about twice as broad as mesosternal lobe at apex (Fig. 4); trochanters exposed. Metasternum length about twice length of mesocoxa; venter setose. Foretibia broadly triangular or macrodentate (Fig. 28–30); mesial protibial spur much larger than lateral, strongly curved posteriorly.

TYPE SPECIES.—*Batuliomorpha comata* Doyen.

Key to the species of **Batuliomorpha**

- 1. Anterior tibia with lateral margin scalloped (Fig. 28, 29), bearing row of coarse, blunt spines ..... 2
- Anterior tibia with lateral margin produced as two very large, spatulate teeth (Fig. 30); margin without spines ..... *tibiudentata*, new species
- 2(1). Pronotum with lateral carina represented by row of small, discrete tubercles; lobe of mesosternum laterad of mesocoxal cavity much narrower than corresponding lobe of metasternum (Fig. 4) .. *comata*, new species
- Pronotum with lateral margin finely carinate; lobe of mesosternum laterad of mesocoxal cavity subequal to corresponding metasternal lobe ..... *imperialis*, new species

*Batuliomorpha imperialis*, new species

Obese, dark brown, setose and laterally fimbriate beetles with proximal ends of lateral epistomal sutures subfoveate.

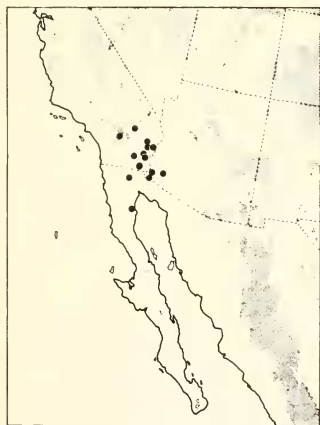
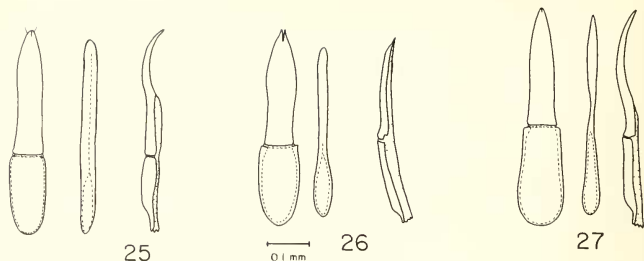


FIGURE 24. Distribution of *Batulius setosus*.



FIGURES 25-27 Male genitalia of species of *Batulimorpha* (ventral aspect, left; lateral aspect, right; median lobe, center). 25) *B. comata*, 26) *B. imperialis*, 27) *B. tibiodentata*.

**FEMALE.**—Epistomum arcuately convex or briefly truncate in middle; lateral epistomal sutures deeply impressed, subfoveate at proximal ends; epistomum scabrous, sculpture becoming finely, rugosely punctate on vertex; epistomal canthus and postgena asetose; postgena coarsely, shallowly punctate.

Pronotal disk colliculate-punctate, with short, sparse, appressed setae in lateral eighths and along posterior margin; lateral borders narrowly margined, crenulate, bearing sparse fringe of projecting setae about one-half length of protibia; posterior angles very broadly obtuse, angulate; posterior border narrowly margined; prosternum and prosternal process coarsely, shallowly punctate, medially with few setae about one-half length of protibia.

Elytral disk weakly undose and finely, seriatly punctate, becoming more coarsely so laterally; alternate rows with tubercles supertending fine, inclined setae about one-half length of protarsus medially to one-third to one-half length of protibia laterally; epipleuron narrowed abruptly about one-fourth distance from humerus, asetose. Meso- and metasternal lobes subequal laterad of mesocoxal cavity (as in Fig. 5); metasternum with large, shallow punctures, with few setae about one-half length of protarsus; metepimeron with large, shallow punctures; abdominal sternites

sculpted like metasternum, but more densely setose; punctures denser on last two sternites.

Profemur with sparse irregular posteroventral fringe of setae about one-half length of protarsus; meso- and metafemora with sparse anteroventral fringe of slightly longer setae; similar setae scattered on dorsal surface. Protibia with lateral margin coarsely, shallowly crenate, bearing about five coarse blunt spines and about four closely set blunt spines at apical angle (Fig. 28); few coarse spines on posterior surface; row of spinose setae on mesial margin; mesial angle scarcely produced; mesial spur much longer, stouter than lateral. Meso- and metatibia bearing longitudinal bands of sharp, coarse, projecting spines on anterolateral surface; sparse fringe of long, inclined setae on posterior surface.

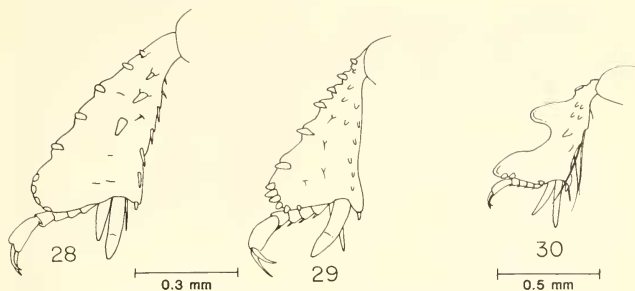
**MALE.**—Differs as stated in description of tribe. Aedeagus as in Fig. 26.

**MEASUREMENTS.**—EL 1.7-2.4 mm, EW 1.35-1.8 mm, PL 0.7-0.9 mm, PW 1.2-1.6 mm.

**HOLOTYPE.**—Female (CAS) and 38 paratypes from California, Imperial County, Algodones Dunes, 3.5 mi SE Glamis, II-26-1978, F. Andrews, A. Hardy.

**ADDITIONAL PARATYPES.**—Same data, IV-28-1978 (28); Glamis, IV-24-1972, pit trap, M. Wasbauer (1); 7.0-7.4 mi SE Glamis, III-19/IV-14-1979 (33).

**DIAGNOSIS.**—*Batulimorpha imperialis* is most similar to *B. comata* Doyen, but has the meso-



FIGURES 28-30. Right foretibiae of species of *Batuliomorpha*, anterior aspect. 28) *B. imperialis*, 29) *B. comata*, 30) *B. tibidentata*.

and metasternal lobes subequal and aligned laterad of the mesocoxal cavities and has the ventral surface shallowly, coarsely punctate (sternal lobes offset in *B. comata*; ventral surface tuberculate).

The distribution of *B. imperialis* (Fig. 32) likely extends into the Gran Desierto, Sonora, Mexico, where some other endemics of the Algodones Dune system occur. Adult activity appears to be restricted to the winter and spring months.

***Batuliomorpha comata*, new species**

(Figure 31)

Obese, dark brown, setose and laterally fimbriate beetles with the sternal lobes laterad of the mesocoxal cavity unequal in width.

FEMALE.—Epistomum shallowly emarginate; lateral epistomal sutures slightly impressed, sometimes subfoveate at proximal ends; epistomum with short, longitudinal carinules, transforming into tuberculopunctate sculpture on vertex; epistomal canthus and postgena near eye with projecting setae about as long as protarsus; postgena faintly scabrous, asetose.

Pronotal disk irregularly tuberculopunctate medially, each crescentic puncture impressed anteriorly by small tubercle; becoming more

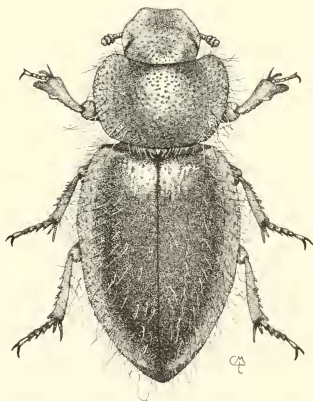


FIGURE 31. *Batuliomorpha comata* from Kelso Sand Dunes, San Bernardino County, California.

coarsely tuberculate in lateral sixths, along posterior margin and lateral two-thirds of anterior margin; tubercles each subtending inclined, fulvous seta about as long as tibia; lateral carina indicated by regular row of setose tubercles; posterior angles obliterated; posterior border narrowly and obscurely margined. Prosternum smooth laterally, finely tuberculate and on prosternal process set with setae about as long as tibia.

Elytra seriatly tuberculopunctate; elongate tubercles anteriorly of shallow punctures, larger in alternate rows and supertending declined setae about as long as protarsus; becoming coarser and supertending longer setae laterally; epipleuron abruptly narrowed one-fourth distance from humerus, asetose. Metasternal lobe extending laterad of mesosternal lobe at mesocoxal cavity (Fig. 4). Metasternum regularly set with round tubercles, each supertending long, declined seta set in very shallow puncture. Metepimeron glabrous. Abdominal sternites sculpted like metasternum, but more clearly tuberculopunctate, most densely so on fifth sternite. Femora finely, irregularly tuberculate, tubercles supertending long fulvous setae. Protibia with serrate lateral margin (Fig. 29), each serration bearing large, blunt spine; five to six subcontiguous spines fringing outer apex; mesial margin with row of short, stiff setae; mesial angle prominent; mesial spur much stouter and longer than lateral. Mesotibia bearing irregular double row of long, blunt spines on lateral margin; long, fine, inclined setae on lateral and posterior surfaces. Metatibia bearing long, blunt spines on anterior and lateral surfaces, whorled with long, fine, inclined setae.

MALE.—Differs as stated in description of tribe. Aedeagus as in Figure 25.

MEASUREMENTS.—EL 1.7–2.7 mm, EW 1.2–1.9 mm, PL 0.6–1.0 mm, PW 1.0–1.6 mm.

HOLOTYPE.—Female (CAS) and 8 paratypes from California, San Bernardino County, Kelso Sand Dunes (8 mi SW Kelso), II-1-1977. J. Doyen, P. Rude, M. Bentzien (J. Doyen Lot # 77B1.1).

ADDITIONAL PARATYPES.—Kelso Dunes, I-13-1965, M. Irwin (5), IV-16/18-1974, F. Andrews, M. Wasbauer (19), II-8-1974, D. Giuliani (22), II-13-1976, F. G. Andrews, A. Hardy (5); 2 mi S Kelso, XII-18-1977, J. Doyen (J. Doyen Lot # 77L4) (2); 9 air mi SW Kelso, VI-29/30-1978, J. Doyen, P. Rude (J. Doyen Lot # 78F4) (3); 10 air mi SW Kelso, IV-23-1977, J. Doyen (2); 2.5 mi E Kelso, II-13-1965, R. Dickson, M. Irwin (3).

ADDITIONAL MATERIAL EXAMINED (Fig. 32).—California, San Bernardino County: Dumont Dunes, 600', V-1-1974, Creosote Assoc., T. Eichlin and A. Hardy (1), II-21-1974, D. Giuliani (1). Arizona, Mohave County: 3 mi SE Parker, VI-28-78, J. Doyen (J. Doyen Lot # 78F3) (1).

DIAGNOSIS.—The unequal meso- and metasternal lobes and the rudimentary lateral carina of the pronotum distinguish *Batuliomorpha comata* from other *Batuliomorpha*, where the sternal lobes are equal and the carina distinct.

Nearly all specimens of *B. comata* have been collected between December and April, suggesting winter activity of the adults. Most individuals have come from pitfall traps. One large collection was made from about the roots of sparse perennial grass (J. Doyen Lot # 77B1.1). At the Kelso Sand Dunes, where *B. comata* is common, collection sites range from the flat apron of sand surrounding the main dune mass to the highest crests. *Batuliomorpha Comata* is known from three sets of dunes in the northeastern Mojave Desert (Fig. 32).

#### *Batuliomorpha tibidentata*, new species

Obese, dark brown, setose and laterally fimbriate beetles with the anterior tibiae produced into two large teeth.

FEMALE.—Epistomum arcuately convex or

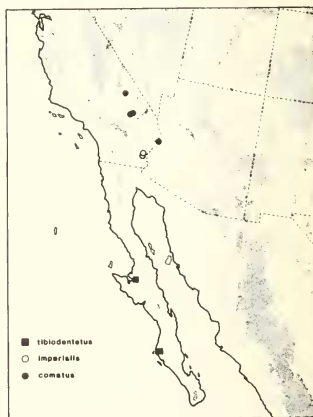


FIGURE 32. Distribution of the species of *Batuliomorpha*.

nearly truncate medially; lateral epistomal sutures lightly impressed; epistomum and vertex with short, longitudinal carinae between eyes, becoming more oblique anteriorly and posteriorly. Epistomal canthus asetose; postgena with few projecting setae about as long as protarsus. Postgena finely tuberculopunctate, bearing a few long setae medially.

Pronotal disk coarsely, closely punctate or weakly tuberculopunctate in medial one-fourth to one-third, becoming tuberculopunctate, then tuberculate laterally and along posterior margin; tubercles in lateral one-sixth to one-third and in posterior one-sixth to one-fifth supertending erect, fulvous setae about two-thirds as long as protibia; lateral carina narrowly margined, finely crenate, bearing fringe of closely set, long, projecting setae; posterior angles obliterated; posterior border very narrowly margined. Prosternum and prosternal process shallowly tuberculopunctate, set with setae about two-thirds as long as protibia.

Elytra very finely, seriatly tuberculate; tubercles supertending inclined, fulvous setae about one-half to two-thirds length of protibia, slightly longer laterally; epipleural carina narrow, crenate, bearing row of closely set long setae; epipleuron gradually narrowed from base to apex, setose. Meso- and metasternal lobes aligned laterad of mesocoxal cavity (as in Fig. 5); metasternum closely set with coarse, shallow punctures bearing setae about one-third to one-half length of protibia. Metepimeron obscurely punctate, asetose; abdominal sternites sculpted like metasternum, but setae slightly longer.

Profemur sparsely set with long fulvous setae on anterodorsal surface; set with shorter setae on basal anteroventral surface; meso- and metafemora sparsely set with long setae on anterior surface. Protibia with small basal, large medial, and very large apical scallop (Fig. 30); few coarse, blunt spines on basal posterior surface, two to three coarse, truncate spines on distal margin; two to three long setae on mesial margin; mesial angle slightly produced; mesial spur slightly larger than lateral. Meso- and metatibia bearing irregular row of long coarse spines on lateral margins; posterior surfaces set with long, inclined setae.

MALE.—Differs as stated in description of tribe. Aedeagus as in Fig. 27.

MEASUREMENTS.—EL 1.6–2.1 mm, EW 1.2–1.5 mm, PL 0.7–0.8 mm, PW 1.1–1.4 mm.

HOLOTYPE.—Female (CAS) and five paratypes from Mexico, Baja California del Sur, 7 mi SE Guerrero Negro, IV-8-1976, J.

Doyen, P. Rude, R. Morrison; on dunes at night, J. Doyen Lot # 76D5. Two paratypes from Baja California del Sur, San Carlos, IX-25-1981, D. Faulkner, F. Andrews, sifted from sand dunes.

DIAGNOSIS.—*Batuliomorpha tibiodentata* is distinguished from all other Anepsiini by its very coarsely tridentate protibiae.

The specimens from near Guerrero Negro were found crawling slowly on the surface of sand hummocks at night. *Batuliomorpha tibiodentata* is known from sand dunes at two localities in south central and central Baja California (Fig. 32).

### Batuliodes Casey

*Batuloides* Casey, 1907:499; Arnett 1960:670.

*Batulius* Doyen and Lawrence, 1979:347 (in part).

TYPE SPECIES.—*Batulius rotundicollis* LeConte, 1851; designated by Casey 1907:498.

Relatively slender to moderately obese ( $0.63 \leq EW/EL \leq 0.75$ ) beetles with mesocoxal cavities closed by apposed meso- and metasterna.

Epistomal margin feebly to distinctly emarginate (Fig. 33). Lateral epistomal sutures weakly to not impressed, often faint, obscured by sculpturing. Antenna 0.7–1.2 times longer than head width; terminal four segments enlarged as distinct club; apical segment longer than broad or subquadrate. Tentorium consisting of subparallel laminae joined by posterior transverse bridge. Pronotum moderately convex, about 1.4–1.6 times broader than long; anterior angles nearly right angled or obtuse, angulate to rounded; posterior angles very broadly obtuse basally, usually exerted and nearly right angled or slightly acute just before apex; lateral pronotal carina complete or absent, subglabrous or fringed with setae. Elytra minutely carinate or tuberculate with seta arising behind each tubercle. Mesocoxal cavities closed by apposed meso- and metasterna; metasternal lobe laterad of coxal cavity broader than mesosternal lobe (Fig. 6); trochantins concealed. Metasternum length about twice length of mesocoxa; venter subglabrous or sparsely setose. Foretibia moderately to very broadly triangular (Fig. 39, 40); protibial spurs subequal or mesial spur slightly larger, curved posteriad.

### Key to the Species of *Batuliodes*

1. Anterior tibia narrowly triangular (Fig. 39); epipleural carina appearing glabrous or nearly so. . . . . 2
- Anterior tibia broadly triangular (Fig. 40);

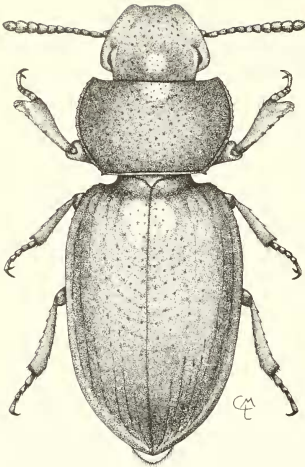


FIGURE 33. *Batuliodes rotundicollis* from Inyo County, California.

- epipleural carina sparsely fimbriate with moderate to long setae, at least anteriorly.....3
- 2(1). Pronotal disk punctate in lateral quarters; intercarinal areas of elytra near epipleuron impunctate or nearly so; aedeagus with paramere attenuate in apical one-third; much longer than tegmen (Fig. 34) .....*rotundicollis* LeConte
- Pronotal disk reticulate or reticulopunctate in lateral quarters; intercarinal areas of elytra distinctly punctate, even near epipleuron; aedeagus with paramere gradually attenuate to very acute apex; subequal in length to tegmen (Fig. 35) .....*confluens* (Blaisdell)
- 3(1). Antenna about three-fourths as long as head width; pronotum with lateral fringe

- of setae; pronotum with posterior angles strongly obtuse or rounded, ill defined.....4
- Antenna about as long as head width; pronotum without lateral fringe of setae; pronotum with posterior angles exerted at apex, nearly right angled.....*wasbaueri* new species
- 4(3). Pronotum with lateral carina absent; hypomeron with lateral row of setae about as long as protarsus.....*obesus* new species
- Pronotum with lateral margin finely, narrowly carinate; hypomeron with lateral row of setae about half as long as protarsus.....*spatulatus* new species

***Batuliodes rotundicollis* (LeConte)**  
(Figure 33)

*Batulius rotundicollis* LeConte, 1851:148.  
*Batuliodes rotundicollis* Casey, 1907:499.

Slender, pale to dark brown, subglabrous beetles with finely carinate elytra.

FEMALE.—Epistomum with lateral lobes prominent, medial portion truncate (Fig. 33); set with nearly round to elongate tubercles anteromedially, these becoming short carinules laterally and posteriorly; vertex tuberculopunctate; postgena and mentum with very shallow, obscure, nearly contiguous, coarse punctures. Antenna about as long as head width; apical segment longer than broad.

Pronotal disk medially with punctures slightly larger than eye facets, separated by one to two puncture diameters; in lateral quarters ectal rims of punctures becoming raised as slight tubercles; lateral carina crenulate, asetose; posterior angles acute or nearly right angled, exerted at apex; anterior angles angulate, nearly right angled. Hypomeron with coarse, exceedingly shallow, often obscure, subcontiguous punctures, sometimes becoming reticulate; prosternum shallowly, coarsely punctate; prosternal process with punctures mostly along margins.

Elytra seriatly, shallowly punctate, punctures interrupting fine, longitudinal carinae; near suture rows of coarser punctures with lower carinae alternating with rows of smaller punctures with more prominent carinae; laterally rows of coarser punctures becoming shallower, obscure or absent

near epipleuron; carinae becoming less pronounced laterally, obscure or absent near epipleuron. Epipleural carina weakly crenulate anteriorly, becoming nearly straight posteriorly; superpeded by irregular row of shallow punctures, these disappearing in posterior third. Metasternum with coarse punctures separated by about one puncture diameter; metepisternum glabrous; abdominal sternites more finely punctate than metasternum; sternites four and five with punctures mainly confined to posterior margins.

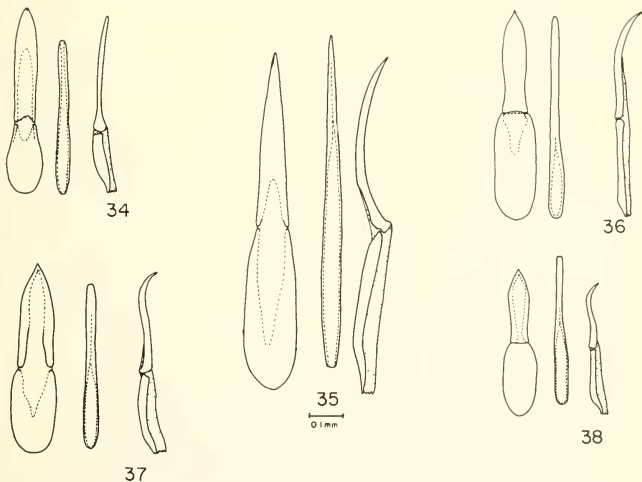
Femora finely, sparsely tuberculate. Protibia (Fig. 39) rather narrowly triangular with about 8-10 coarse, blunt spines along lateral margin; mesial margin with few coarse spines and setae; posterior surface with irregular ridge and row of spines near mesial margin; tibial spurs subequal. Meso- and metatibia each with sparse row of sharp spines along lateral margin, few setae on anterior and posterior surfaces.

MALE.—Differs as stated in description of tribe. Aedeagus as in Figure 34.

MEASUREMENTS.—EL 1.3-2.0 mm, EW 0.1-1.4 mm, PL 0.5-0.8 mm, PW 0.8-1.2 mm.

HOLOTYPE.—Sex not determined; from Gila River valley (MCZ).

ADDITIONAL MATERIAL EXAMINED (Fig. 41).—Arizona, Maricopa County: Buckeye, 2-4-1942 (1); Phoenix, II-9/III-16-1941 (5), II-2-1945 (1); 18 mi W Tonopah, IX-5-1978 (3). Mohave County: 3 mi N, 7 mi E Littlefield, Virgin River, III-28/X-1-1982 (3). Pima County: Lukeville, X-26-1969 (2); Tucson, April (1). Yuma County: Ehrenberg, II-8-1939 (1), II-15-1940 (1); Fort Yuma, I-28 (2); Quartzite, II-27-1940 (4). California, Imperial County: Cargo Muchacho Mtns. Mesquite-Creosote, 480', IV-19/V-27-1979 (3); 3.9 mi N Walter's Camp (1). Inyo County: Eureka Valley, 1978, March, (4), April, (13), May, (58), June, (36), July, (40), August (31), September (13), November/December (1); Eureka Valley, 8 mi N, 4 mi W dunes, 3300', IX-1-78 to V-5-1980 (77); Saline Valley, VI-21-1978/V-18-1979, 1100' (6), 1200' (37), 1360' (28); Grapevine Canyon, IV-20-1978/V-18-1979, 2500' (4), 2700' (5), 3800' (1); NW end Saline Valley, Sand Dunes, 1150', VI-6-1976 (1); Saline Valley Dunes, VI-6-1976 (14), IV-20-1975 (4); Inyo Mountains, Lead Canyon,



FIGURES 34-38. Male genitalia of species of *Batuliodes* (ventral aspect, left; lateral aspect, right; median lobe, center). 34) *B. rotundicollis*, 35) *B. confluens*, 36) *B. wasbaueri*, 37) *B. spatulatus*, 38) *B. obesus*.

3300' V-5/VIII-13-1982 (12). Riverside County: Painted Canyon, IV-15-1974 (3), various dates, V-18-1978-I-7-1979 (4); Riverside Mountains, Crest, Riverside Pass Rd., IV-27/VII-18-1978 (71). San Bernardino County: Daggett, X-17-1951 (1). San Diego County: Borrego, II-3-1939 (5); Carter Lake, III-23-1959 (1). Nevada: Nye County: Rock Valley, IV-11-1975 (1).

**DIAGNOSIS.**—*Batuliodes rotundicollis* is most similar to *B. confluens* (Blaisdell). In *B. rotundicollis* the lateral areas of the pronotal disk are punctate and the intercarinal areas of the elytra near the epipleuron are impunctate or nearly so. In *B. confluens*, the lateral areas of the pronotum are irregularly set with short carinules, causing a reticulate appearance and the intercarinal spaces of the elytra are distinctly punctate, even laterally. In addition, the aedeagi of these two species are different in shape and very different in size (Fig. 34, 35).

*Batuliodes rotundicollis* occupies arid habitats from east central California and southern Nevada south to extreme southern California and east to central Arizona (Fig. 41). No collection records exist, but the beetles undoubtedly inhabit extreme northern Baja California and Sonora.

Many collections are from aeolian dunes, but

others are from sandy washes, areas of desert pavement, or stoney regions. Nearly all specimens have been collected in pitfalls. In contrast to the predominantly winter activity of most of the species inhabiting dunes, *rotundicollis* is most abundant during the warm season.

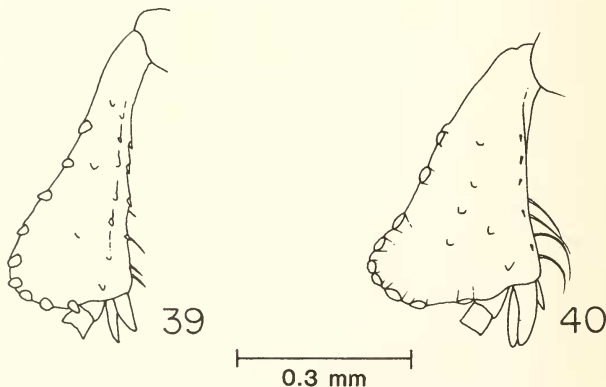
***Batuliodes confluens*** (Blaisdell) (new combination)

*Anepsius confluens* Blaisdell, 1923:243; 1943:218.

*Anepsius angulatus* Blaisdell, 1923:244; 1943:218. (new synonymy)

Slender, brown to black beetles with finely carinate elytra.

**FEMALE.**—Epistomum truncate anteriorly or with lateral lobes slightly more prominent than middle; sparsely set with round or elongate tubercles anteriorly, becoming tuberculopunctate posteriorly on vertex and tubercles becoming short, sometimes anastomosing carinules, producing reticulate appearance, especially laterally above eyes; postgena and mentum with shallow, nearly contiguous, coarse punctures. Antenna about as long as head width; apical segment longer than broad.



FIGURES 39-40. Right foretibiae of species of *Batuliodes*, anterior aspect. 39) *B. rotundicollis*, 40) *B. spatulatus*.



Pronotal disk medially with punctures about two eye facets in diameter, separated by about one puncture diameter or less; laterally, ectal rims becoming raised as low carinules, these becoming strong and anastomosing in lateral thirds, producing reticulate surface; lateral carina crenulate, asetose. Posterior angles acute or nearly right angled, exerted at apex; anterior angles angulate, nearly right angled. Hypomerion scabrous, longitudinally strigose, with scattered, coarse, shallow punctures, often obscure; prosternum and prosternal process shallowly, coarsely, subcontiguously punctate.

Elytra seriatly punctate; in alternate rows punctures interrupting fine longitudinal carinae; carinae weakest near suture, becoming very distinct laterally, where anterior rims of punctures are raised; rows between carinae with each puncture attended anteriorly by slight tubercle, anterior rim slightly raised laterally; intercarinal areas becoming more weakly sculpted posteriorly and usually smooth on declivity. Epipleural carina weakly serrate or crenulate near humerus, becoming nearly straight posteriorly, bearing sparse line of short, appressed setae; supertended by irregular row of obscure, shallow punctures. Metasternum with coarse, setigerous punctures separated by about one puncture diameter; setae short, appressed or declined; metepimeron obscurely, shallowly, and coarsely punctate; abdominal sternites sculpted as metasternum, sometimes more finely so; sternites four and five usually with punctures mostly near posterior margin.

Femora with few fine tubercles or obscure punctures. Protibia nearly as in *Batuliodes rotundicollis* (Fig. 39), posterior surface with scattered tubercles, ridge near mesial margin usually indistinct; meso- and metatibia with few short spines and scattered tubercles on ectal surface and sparse, short, appressed setae.

MALE.—Differs as stated in description of tribe. Aedeagus as in Figure 35.

MEASUREMENTS.—EL 1.6–2.4 mm, EW 1.0–1.4 mm, PL 0.6–0.9 mm, PW 0.9–1.2 mm.

HOLOTYPE.—Male in the California Academy of Sciences, San Francisco.

TYPE LOCALITIES.—Mexico, Baja California Sur, Isla Partida, (*B. confluens*); Mexico, Baja California Sur, Loreto, Arroyo Gua (*B. angulatus*).

ADDITIONAL MATERIAL EXAMINED (Fig. 41).—Mexico, Baja California (Norte): Tijuana, IV-14-1942 (2); Arroyo Catavina, 35 mi S El Progreso, IV-2-1976 (1); 2.7 mi SE Catavina, VII-4-1979 (8); 6.2 mi W Bahía de Los Angeles (31); 10 mi S Punta

Prieta, VI-21-38 (2); 6.2 mi NE Rosarito, VII-10-1979 (20); 57 mi E El Rosario, 2 mi E San Fernando Velicata, VII-2-1979 (2); 2 mi NW Rancho Santa Ynez, III-27-1973 (3). Baja California Sur: 2 mi E San Ignacio, VII-6-1979 (6); Rancho Mesquital, 21.4 mi E San Ignacio, VII-9-1979 (11); Rancho Tablon, 13 km S Guillermo Prieto, IV-16/18-1983 (11); 12 mi S Guillermo Prieto, IV-7-1982 (1); 34.4 mi SE Guerrero Negro, IX-22-1981 (1); Isla Mejia, IV-20-1921 (1); Isla Carmen, V-23/VI-6-1978 (7); Isla Estanque, VII-1-1921 (1); Isla Monserrate, VI-11/23-1978 (3); Isla Raza, IV-21-1921 (1).

DIAGNOSIS.—*Batuliodes confluens* is very similar to *B. rotundicollis* LeConte, differing as stated in the discussion of the latter. The habits of *B. confluens* seem to be similar to those of *B. rotundicollis*, with occupation of many different substrates and adult activity through the hot part of the year.

#### *Batuliodes wasbaueri* new species

Moderately obese, brown, subglabrous beetles with very broadly triangular protibiae.

FEMALE.—Epistomum with lateral lobes prominent, usually extending well beyond truncate middle; sparsely, evenly set with round tubercles

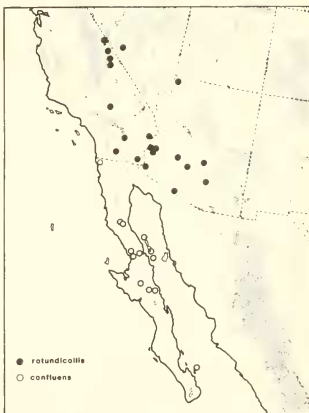


FIGURE 41. Distribution of *Batuliodes rotundicollis* and *B. confluens*.

slightly larger than eye facets; tubercles becoming elongate posteriorly and carinate posterolaterally near eyes; postgena coarsely, subcontiguously punctate; mentum scabrous; antenna about as long as head width; apical segment longer than broad.

Pronotum medially with punctures about 1.5 times diameter of eye facets, separated by one to several puncture diameters, becoming denser laterally; punctures attended ectally by longitudinal carinules, strongest in lateral quarters; lateral carina distinct, fine, immediately subtended by row of asperities, producing thickened appearance; posterior angles nearly right angled, exerted at apex; anterior angles angulate, slightly obtuse; hypomeron, prosternum, and prosternal process coarsely punctate; punctures separated by less than one puncture diameter.

Elytra confusedly set near suture with shallow, ill-defined punctures about as large as eye facets; punctures attended anteriorly by small, slightly elongate tubercles; laterally punctures becoming smaller, very poorly defined, and tubercles becoming more elongate, then carinate in lateral thirds; carinules and punctures becoming obsolete in alternate one to two rows adjacent to epipleuron; epipleural carina evenly margined, forming prominent, explanate humerus; sparsely fringed by short, declined setae; metasternum with coarse punctures separated by about one puncture diameter or less; metepisternum with few coarse punctures; abdominal sternites more finely punctured than metasternum; punctures mostly on posterior margins of sternites four and five.

Femora finely, sparsely punctate: Protibia very broadly triangular (as in Fig. 40) with about 9–11 very coarse, blunt spines along lateral margin, subcontiguous around angle; mesial margin with four to five slender setae about one-fourth to one-third length of protarsus; posterior surface sparsely tuberculate; tibial spurs subequal. Mesotibia with row of 2–4 stout spines along ectal margin, scattered spinose setae; metatibia with few smaller spines on ectal margin, scattered spinose setae.

MALE.—Differs as stated in description of tribe. Aedeagus as in Figure 36.

MEASUREMENTS.—EL 1.7–2.4 mm, EW 1.2–1.7 mm, PL 0.7–0.9 mm, PW 1.1–1.4 mm.

HOLOTYPE.—Female (CAS) and one paratype from California, Imperial County, 5 mi N Glamis, IX-10-1974, M. Wasbauer, R. McMaster, pit trap. Additional paratypes as follows.

California, Imperial County: Glamis, IV-24-1972, M. Wasbauer, pit trap (3), V-29-1971, M. Wasbauer, pit trap (11); Algodones Dunes, 12.4 mi ESE Holtville, IV-13-1979 (1); Algodones Dunes, 2.5 mi NE Coachella Bridge #1, IV-17-1979 (1); Seeley, V-8-1970 (1) Paddock, Flock and Johnson. Mexico, Baja California (Norte), 20 mi S Palacio [=Palaco?], IV-4-1939, E. Ross (2).

DIAGNOSIS.—*Batuliodes wasbaueri* is similar to *B. confluens* (Blaisdell), but has the protibiae very broadly triangular (much narrower in *B. confluens*) (Fig. 39, 40). *Batuliodes wasbaueri* is similar to *B. spatulatus* Doyen, differing as indicated in the discussion of the latter. *Batuliodes wasbaueri* appears to be endemic to the Algodones Dunes, although it lacks most of the morphological specializations that distinguish the truly psammophilous species such as *Batuliodes obesus* and the species of *Batuliomorpha*.

#### *Batuliodes spatulatus* new species

Brown, strongly convex, obese beetles, with inconspicuously setose elytra and very broadly triangular protibiae.

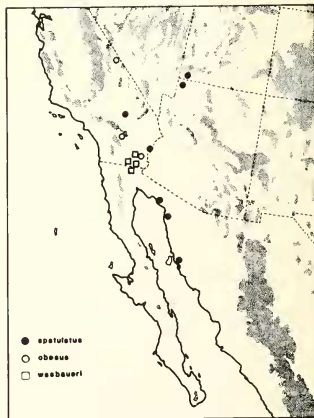


FIGURE 42. Distribution of *Batuliodes spatulatus*, *B. wasbaueri*, and *B. obesus*.

**FEMALE.**—Epistomum with lateral lobes slightly more prominent than middle, which is truncate or concavely arcuate; set with round tubercles slightly larger than eye facets, these becoming elongate posteriorly on vertex and often carinulate; postgena and mentum shallowly, coarsely punctate. Antenna about three-fourths as long as head width; apical segment about as long as broad.

Pronotum medially with shallow punctures slightly larger than eye facets, separated by one to several puncture diameters; attended ectally by low tubercles, these becoming stronger and longitudinally elongate laterally and forming short carinules near lateral margins; lateral carina very fine, narrow and even; posterior angles strongly obtuse but definitely angulate; anterior angles rounded. Hypomeron glabrous except for few punctures on coxal cowl and band of setigerous tubercles just below pronotal carina; setae stiff, slightly curved, about one-third to one-half as long as protarsus; prosternum with few setigerous punctures medially with anterior rims tuberculate raised; setae about as long as protarsus; prosternal process with few marginal punctures.

Elytra seriatly tuberculate, tubercles anteriorly attending shallow, ill-defined punctures; tubercles smaller, ill defined, less regular near suture, often appearing confused, becoming slightly stronger, more elongate laterally, sometimes forming interrupted carinules; punctures disappearing near epipleuron and on declivity; alternate rows of tubercles larger, especially laterally; sometimes supertending short, declined setae, especially laterally; rows of smaller tubercles becoming obsolete laterally and posteriorly, disappearing near epipleuron and on declivity; epipleural carina narrow, weakly crenate, bearing row of slightly curved setae about one-third to one-half length of protarsus. Metasternum with coarse, shallow, setigerous punctures separated by about one puncture diameter; setae exceedingly fine, very short; metepisternum with few obscure punctures; abdominal sternites one to two sculpted like metasternum, but more finely, sparsely so; punctures sparser medially and on last three sternites mostly on posterior margins.

Femora polished, with scattered minute setae. Protibia very broadly triangular (Fig. 40), with row of very short, blunt spines along lateral margin, becoming subcontiguous around angle; mesial margin with row of about five curved setae about two-thirds length of protarsus; posterior

surface with few scattered tubercles, short spinose setae; mesial tibial spur longer, stouter than lateral; strongly curved. Meso- and metatibia with row of three to four coarse, spines on ectal margins; posterior surfaces sparsely, irregularly set with inclined setae about one-half to two-thirds length protarsus.

**MALE.**—Differs as stated in tribal description. Aedeagus as in Figure 37.

**MEASUREMENTS.**—EL 1.6–2.2 mm, EW 1.1–1.6 mm, PL 0.6–0.9 mm, PW 0.9–1.3 mm.

**HOLOTYPE.**—Female (CAS) and six paratypes from California, San Bernardino County, 9 air mi S Baker, VII-1-1978, J. Doyen, P. Rude (J. Doyen Lot # 78F5).

**ADDITIONAL PARATYPES.**—Same locality IV-27-1977, J. Doyen (J. Doyen Lot # 77D2) (2). Riverside County: Sand dunes 1 mi W Blythe, V-23/24-1970, pit trap, J. Johnson, M. Washbauer (19). Utah, Washington County, 2 mi E Washington, V-20/V1-8-1980, R. Hardy (3).

**ADDITIONAL MATERIAL EXAMINED** (Fig. 42).—Arizona, Mohave County: 3 mi N, 7 mi E Littlefield, Virgin River, III-28/X-1-1982 (2). Mexico, Sonora: Cholla Bay, 6 mi N Puerto Penasco, III-18/19-1980 (1); El Desemboque, III-22-1980 (6); 1 mi W Bahía de San Carlos, III-23-1980 (7).

**DIAGNOSIS.**—*Batuliodes spatulatus* is very similar to *B. obesus* Doyen, differing as described in the discussion of the latter. It is also similar to *B. wasbaueri* Doyen, but *B. wasbaueri* entirely lacks the fringe of pronotal setae present in *B. spatulatus* and has the antennae as long as the head width (about three-fourths head width in *B. spatulatus*).

*Batuliodes spatulatus* is geographically variable. Specimens from California and Utah have the elytral disk very sparsely setose or subglabrous; if setae are present, they are only about as long as the basal protarsal segment. The pronotal and epipleural setae are about one-third the length of the protarsus. Specimens from Sonora have the elytra setose and the pronotal and epipleural setae are about one-half the length of the protarsus.

#### *Batuliodes obesus* new species

Pale tan, strongly convex, obese beetles with setose elytra and with pronotal carina obliterated.

**FEMALE.**—Epistomum with lateral lobes prominent, extending well beyond truncate middle; sparsely, evenly set with round tubercles slightly larger than eye facets, occasionally becoming carinulate posteriorly on vertex; postgena and mentum nearly smooth with few, obscure punctures. Antenna about three-fourths as long as head width; apical segment about as long as broad.

Pronotum medially with shallow punctures about twice eye facet diameter, separated by about one puncture diameter; becoming denser,

smaller, and less well defined laterally and attended ectally by slightly elongate tubercles in lateral thirds of disk; few short, declined setae near margins of disk; lateral carina absent; posterior angles rounded, strongly obtuse, scarcely indicated; anterior angles rounded. Hypomeron polished, glabrous except for few punctures on coxal cowl and somewhat irregular band of posterodorsally curved setae about as long as protarsus near dorsal margin and on lateral sixths of anterior margin; prosternum and prosternal process glabrous except for few long, curved setae.

Elytra seriatly tuberculate; rounded tubercles anteriorly attending shallow, ill-defined punctures near suture, these becoming smaller laterally and posteriorly and virtually disappearing near epipleuron and on declivity; alternate rows of tubercles larger, setigerous; setae about one-half length of protarsus, inclined, slightly curved; rows of smaller tubercles becoming obsolete laterally and posteriorly and disappearing near epipleuron and on declivity; epipleural carina scarcely elevated, indicated by row of small, round setigerous tubercles anteriorly, becoming carinate in anterior and posterior one-fifth but not prominent; tubercles separated by about one tubercle diameter; setae about as long as protarsus, slightly curved posterodorsad. Metasternum with coarse, very shallow, setigerous punctures, separated by one to several puncture diameters; setae about as long as basal metatarsal segment; metepisternum with few obscure punctures; abdominal sternites sculpted like metasternum, except for setae being about one and one-half to two times longer; punctures sparser medially and on sternites three to five mostly near posterior borders. Legs essentially as in *spatulatus* (Fig. 40).

MALE.—Differs as stated in tribal description. Aedeagus as in Figure 38.

MEASUREMENTS.—EL 1.4–1.8 mm, EW 1.0–1.4 mm, PL 0.5–0.8 mm, PW 0.9–1.2 mm.

HOLOTYPE.—Female (CAS) from California, Imperial County, 1 mi S Glamis, III-31-1978, J. Powell, in pitfall. Paratypes: Imperial County: 2 mi N Glamis, I-27-1977, J. Doyen, on sand at night (1); Glamis, V-29-1971, pit trap, M. Washbauer (1); 5.5 mi SE Glamis, VII-19-1978, A. Hardy, F. Andrews, pit trap (1); 7 mi SE Glamis, III-25/IV-8-1979, pit trap (1). Riverside County: 5 mi NW Indio, III-4-1972, F. Andrews, E. Kane, A. Hardy (1). Inyo County: Death Valley, Stovepipe Wells Sand Dunes, IX-14-1972, D. Giuliani.

DIAGNOSIS.—*Battuliodes obesus* is very similar to *B. spatulatus* Doyen. In *B. obesus* the lateral pronotal carina is absent and the hypomeral setae

are about as long as the protarsus and curve strongly posterodorsad. In *spatulatus* the pronotal carina is fine but complete, and the hypomeral setae are about half as long as the protarsus.

*Battuliodes obesus* is restricted to aeolian sand dunes, with morphological adaptations for a psammophilous mode of life similar to that of *Battuliomorpha*. All specimens have been collected during the winter months, save that from Death Valley, which is badly abraded, lacking setae, and may have been found dead.

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Of special note is the material housed in the collection of the California Department of Food and Agriculture. This is the largest collection of sand dune Coleoptera from western North America, and contains more than one-half the known specimens of *Anepiini*. About a quarter of the known specimens are housed in the Essig Museum of Entomology, University of California, Berkeley.

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## APPENDIX I

## Characters and Character States

Plesiomorphic character states are listed first, apomorphic states last. Some characters, such as antennal shape (1, 2), posterior pronotal angles (11, 12) and hypomeron sculpture (13, 14) are listed twice because more than 2 character states are recognized. A double listing allows such characters to be coded in an additive binary fashion.

1. Antennal shape: a) clavate (or four-segmented club); b) three-segmented club.
2. Antennal shape: a) clavate (or three-segmented club); b) four-segmented club.
3. Antennal length: a) at least as wide as head; b) three-fourths as wide as head or less.
4. Antennal length: a) at least three-fourths as wide as head, one-half as wide as head or less.
5. Apical antennal segment: a) apical segment much longer than wide; b) apical segment subquadrate or nearly round.
6. Tentorium: a) open posteriorly; b) closed posteriorly between bridge and occiput (Fig. 2).
7. Epistomal margin: a) shallowly emarginate or truncate; b) lateral lobes prominent; middle recessed.  $\pm$  straight (Fig. 33).
8. Submental gland: a) present; b) absent.
9. Pronotal margin: a) glabrous or with short, appressed setae; b) fimbriate.
10. Pronotal lateral carina: a) distinct, carinate; b) absent.
11. Posterior pronotal angles: a) obtuse (or rounded, absent); b) exerted, about 90° or acute.
12. Posterior pronotal angles: a) angulate, distinct; b) absent.
13. Hypomeron sculpture: a) scabrous, rugulose, or smooth; b) coarsely punctate.
14. Hypomeron sculpture: a) scabrous, rugulose (or punctate); b) smooth polished.
15. Elytral margin: a) glabrous or with short, appressed setae; b) fimbriate.
16. Elytral sculpture: a) carinae interrupted by punctures; b) tuberculate, punctate.
17. Ventral setation: a) subglabrous or short, sparse setae; b) long semi-erect setae.
18. Mesocoxal closure (Fig. 4-6): a) narrow space between lobes of meso- and metasternites; b) sternite lobes touching.
19. Sternite lobes (Fig. 4-6): a) mesosternal and metasternal lobe subequal in width laterad of coxal cavity; b) metasternal lobe much broader than mesosternal.
20. Mesotrochantin (Fig. 4-6): a) exposed; b) concealed.